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Consortium for Robotics and Unmanned Systems Education and Research (CRUSER)

2011-05-12

CRUSER : From Technical to Ethical, From Concept to Experimentation [presentation]

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Monterey, California: Naval Postgraduate School

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12 May 2011
Captain Jeff Kline, USN (ret)
Director, *CRUSER*

<http://www.nps.edu/Research/CRUSER>

From Technical to Ethical From Concept Generation to Experimentation

The Naval Postgraduate School's **Consortium for Robotics and Unmanned Systems Education and Research (CRUSER)** provides a collaborative environment and community of interest for the advancement of unmanned systems education and research endeavors across the Navy and Marine Corps

Organization

Oversight

Sponsor:
SECNAV

Funding:
ONR

Off Campus
Steering
Group

On Campus
Advisory
Board

Coordination

Coordination Group:

Jeff Kline, Director

Dr. Timothy H. Chung, Director of
Research and Education

Carol O'Neal , Director of
Innovation and Concept
Development

Archiving, Admin, Outreach, and Accounting
Operations Manager: Lisa Trawick
Archiving: Knox Library
Accounting: T. Genegabus

Execution

Students, Faculty,
and Researchers

Field
Experimentation

Center for
Autonomous
Vehicle Research

Center for
Network
Innovation and
Experimentation

FY11–FY13 Objectives

- Provide source of **Concept Generation** for operations and technical research
- Provide **Experimentation** Program to evaluate Employment Concepts
- Provide venue for **education** in robotics, autonomy, and unmanned systems
- Provide DoD-wide forum for **collaborative education, research** and experimentation

Concept Generation Events

- UxS systems employment to mitigate loss of space systems (FY10) – NWDC/SSG
- Advanced Undersea Warfare Systems (AUWS) Warfare Innovation Workshop (FY11) – Systems Engineering Analysis
- UxS employment for military deception (FY11) – Joint Campaign Analysis Class
- Future Unmanned Naval Systems (FUNS) Wargame Competition (FY11)



AUWS – Dec 2010



FUNS Wargame – Mar 2011



Concept Generation: Upcoming Events

- UxS employment in Naval Operations (FY12)
 - Two teams
 - NPS Students/Young Engineers from Navy Labs
 - Civilian Engineers from industry/NPS Faculty
 - Challenge: Develop revolutionary Concept Generation from evolutionary UxS technology changes
 - Ex: How many innovative employment concepts can you develop for the Fire Scout?
- NPS Operations Research Joint C4I class
 - Spring 2011
 - Creating a concept for a littoral C4I expeditionary module to control manned and unmanned systems and sensors



Experimentation Events

- Current activities of Capabilities Based Experimentation
 - USSOCOM-NPS Field Experimentation Cooperative Capabilities Based Experimentation (TNT)
 - Research & Experimentation for Local & International Emergency & First Responders (RELIEF)
- NPS students participation in outside experiments and tests



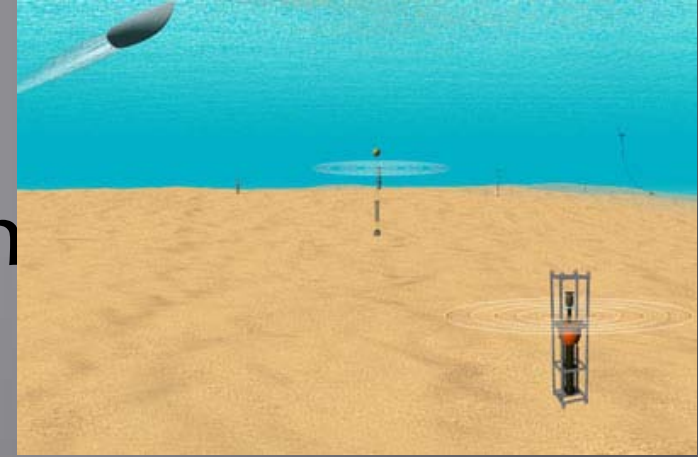
Prof Jamie MacMahon & students with EcoMapper UUV



NPS Students at TNT Experiment

Experimentation: Upcoming Events

- MIO remote sensor control demonstration in Singapore (FY11)
- Seaweb experimentation in coordination with Singapore (FY12-13)
- UxS in Naval Operations Experiment (FY13)



Seaweb



Education Events

- NPS Departments offering Unmanned System courses
 - Physics
 - CS
 - MAE
 - SE
 - IS (C4I)
 - USW (AG)
 - SS (AG)
 - MOVES
 - Applied Math
- Robots in the Roses Research Fair
 - Official “Launch” of CRUSER on 31 March 2011
 - Twenty NPS Participants brought displays and potential thesis topics for students



Robots in the Roses – March 2011



Education: Student Research

Focus NPS student thesis and project work with CRUSER research

- Capability to search in-progress thesis topics for CRUSER related research
- LT Matthew Larkin – Brave New Warfare: Autonomy in Lethal UAVs – Mar 2011
- LT Steve Halle and LT Jason Hickle – The Design and Implementation of an Autonomous Surf Zone Robot using Advanced Sensors and a Common Robot Operating System
- Mr Michael Day - Multi-Agent Task Negotiation Among UAVs to Defend Against Swarm Attack



STEM Events

Science, Technology, Engineering, and Math (STEM)

- OR Robotics Day – Aug 2010
- First Lego League of Monterey – Nov 2010
- Monterey Academy of Oceanographic Sciences(MAOS) visit – Mar 2011
- “Girl’s Day In” – Mar 2011
- Robots in the Roses – Mar 2011
- Monterey County Science Fair – Mar 2011
- First Lego League of Monterey – Apr 2011



First Lego League – Apr 2011



Robots in the Roses – Mar 2011



Girl's Day In– Mar 2011

Education: Upcoming Events

- Social, Cultural, Political, Legal and Ethical employment of UxS systems in Naval Operations (FY12)
 - Primary purpose is educational, not the advancement of the ethical discipline
 - Target audience of military officers and DoD civilians concerned with operations, acquisition, and engineering of unmanned systems
- Catalog degree programs, short courses, and certificate programs country wide(FY13)
- Create short course programs as identified by community of interest (FY13-14)
- Align curriculum for interdisciplinary autonomous vehicle system degree

Research: Upcoming Events

FY 12 Call for Proposals

- **Holistic approach:**
 - Technical : Power, Sensors, Controls, Communications, Architectures, Human Factors, Information Processing and dissemination
 - Concept Generation, Employment
 - New technologies within maritime mission sets
 - Defense against Red capabilities
 - Experimentation
 - Human Capital Requirements, Risk Analysis, Force Transition, Acquisition, Organizational, Policy, and Authorities
 - Social, Cultural, Political, Ethical and Legal

Collaborative Events

- CRUSER Community of Interest (CoI) data base
- Unclassified CRUSER Portal Wiki
 - Centralized location to distribute CRUSER Information
 - CRUSER CoI Listing
 - CRUSER Calendar of Events
 - <https://wiki.nps.edu/display/CRUSER/>
- CRUSER newsletter
 - Monthly Publication
 - Released mid-month
 - http://www.nps.edu/research/cruser/cruser_newsletters.html
 - Articles for publication are accepted at cruser@nps.edu



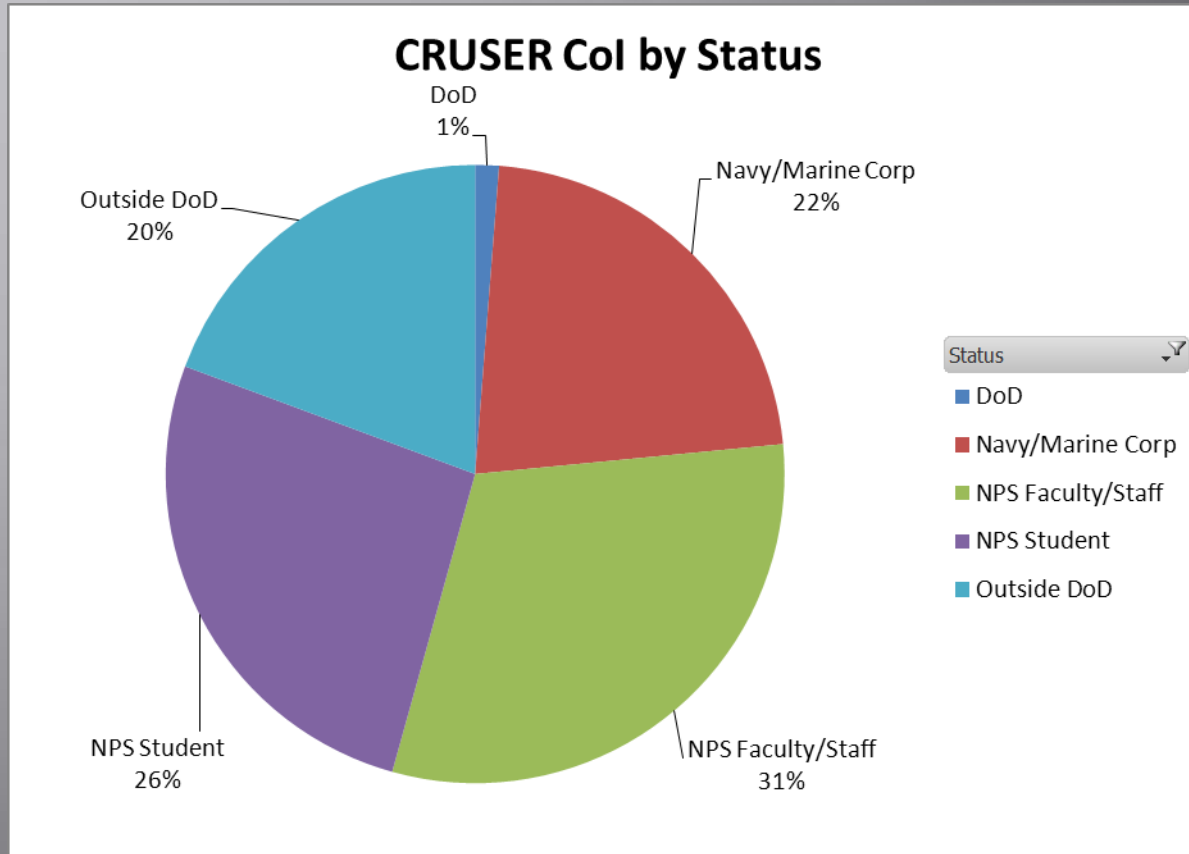
Collaborative: Upcoming Events

- Classified Portal to post research and research requests from Community of Interest (FY11 – 12)
- Create DoN accessible education and research data base (FY12)
- Leverage current Capabilities Based Experimentation program, Center for Autonomous Vehicle Research, and Center for Network Innovation and Experimentation for UxS system maritime mission experiment (FY13)



CRUSER

Community of Interest (Col)



- There are currently over 240 members



- A Sample of some of the organizations represented in the CRUSER CoI:

- NUWC
- NWDC
- OPNAV N2/N6
- SSC Pacific
- ONR
- OPNAV
- Georgia Tech Research Institute
- USNA
- NSWC Panama City Division
- Orca Maritime, Inc.
- NSWC
- COMSUBDEVRON TWELVE
- MBARI
- JHU Applied Physics Laboratory
- Institute for Religion and Peace
- USMA
- HQMC Aviation
- NAVSEA
- NSWCDD
- SAIC Panama City Beach
- DUSN
- Bluefin Robotics Corporation
- NWC
- SPAWAR
- Aurora Flight Sciences
- Tactical Air Support, Inc.
- MIT Humans and Automation Laboratory
- OSD
- NMAWC
- AUVAC
- NAVAIR
- Unmanned Vehicle Systems Consulting, LLC
- COMPACFLT N00WAR
- Rockwell Collins
- NRL
- USFFC



Proposed FY12–13 UxS Mission Thread: Specific Maritime Mission

Concept Generation
of UxS Systems in
Support of Naval
Operations

Navy and Industry
Wide Technical
Symposium in
Support of Naval
Operations

UxS Systems Field
Experimentation in
support of Naval
Operations

Provide mission scenario for cross campus use in classes, projects, thesis research, and at sea experimentation

Potential for many Interested Sponsors and Collaborators:



Specific Proposed FY12-13 Mission Thread Events

Fall Qtr 2012

UxS in Naval
Operations
Concept
Generation

Winter Qtr 2012

Social, Cultural,
Political , Legal and
Ethical Issues on
UxS employment to
Support Naval
Operations

Spring Qtr 2012

Three Day UxS
in mission
technical
symposium

Summer Qtr 2012

Fall Qtr 2013

Five Day
mission
experimentation

Winter Qtr 2013

Spring Qtr 2013

Washington
Symposium
Research Expo

Summer Qtr 2013

Concept Generation of UxS
Systems in Support of Naval
Operations

Navy and Industry Wide
Technical Symposium in
Support for Naval Operations

UxS Systems Field
Experimentation in support
for Naval Operations



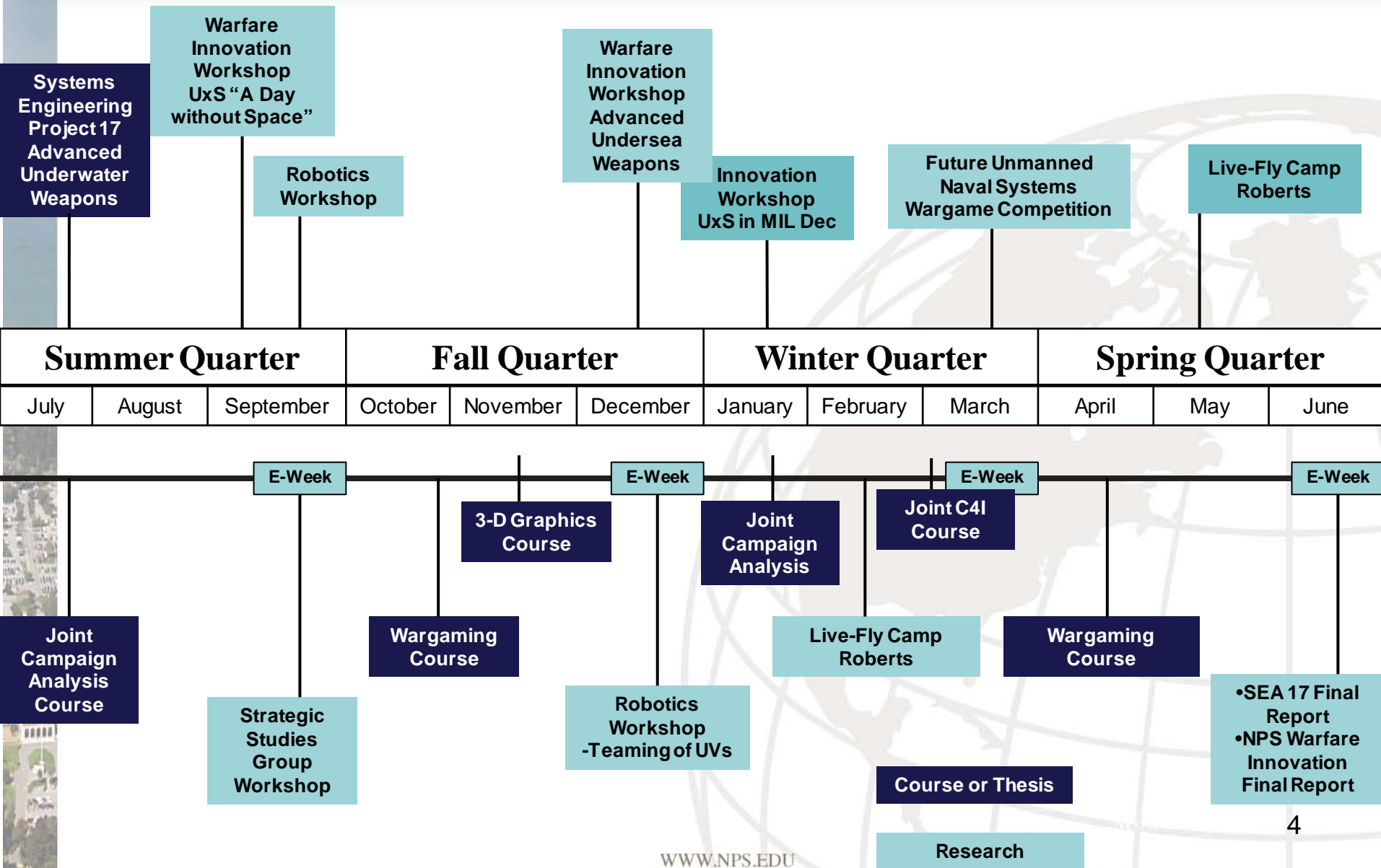
REFERENCE SLIDES

Alternatives for Steering Group

- Fleet Focused:
 - FFC, PACFLT, C10F, NWDC, DEVRONs, SWDG, NSWAC, MCCDC, NMAWC
- Resourced Focused:
 - OPNAV N2/6, PEO UMS, PEO LMW, NAVSEA, NAVAIR, Marine Corps Systems Command, OPNAV N1, OPNAV N4
- Combination:
 - FFC, MCCDC, OPNAV N2/6, Marine Corps Systems Command



July 2010 – June 2011 Current Planned NPS UxS Activities



Fiscal Year Plan 11 – 15

FY 11	FY12	FY13	FY14	FY15
\$200K	\$1.5M	\$3M	\$5M	\$5M

Alternative Mission Threads

- Sea Based ISR and Logistics Support to Expeditionary forces and SOF
- Use of inexpensive UAV to counter threat UAV swarm and defend against rocket, artillery, mortar, and missile attacks
- Maritime Interdiction Operations
- UUV in track and trail
- UxS in maritime operational deception (counter-targeting)